

# IMPROVED WOMBAT METHOD FOR PROCESSING SCRAP TIRES INTO USEFUL MATERIALS

by

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The Wertz Oxidative Molecular Bombardment at Ambient Temperature (WOMBAT) process is a sequence of redox reactions which has been used for several years to degrade scrap tires. This process has, to date, been conducted in adiabatic chemical reactors constructed either from poly-vinyl chloride and/or stainless steel. It has the potential to impact the scrap tire inventory in the United States (and elsewhere) which now has reached about three billion and is increasing by 250-300 million annually just in the United States. As previously shown, the WOMBAT process degrades the tire into four recoverable component parts: (a) the steel from its tread and its bead wire sections, (b) the rubber backing(s), (c) the fibers, and (d) a particulate which is dispersed in the reactor fluid. These results are summarized in Figure 1. After washing the steel, the rubber mats, and the fibers, these components may be separated and then used without further treatments. The particulate has typically been removed from the reactor fluid and then collected by centrifugation and/or filtration. After washing the collected particulate with water and drying in a convection oven, the resulting gel is converted to a carbon-based powder by light grinding. The resulting powder has highly irregular particle surfaces and a high, but somewhat variable, oxygen content.

These high carbon particles are effective as sequestering agents for several divalent cations, eg. Ca(II), Cu(II), Pb(II), Hg(II), etc. In addition, the black powder has a heat content ca. 30% higher than the heat content of the typical bituminous coal and a sulfur content in the 0.3 - 1.0% weight percent range even though this powder contains 10-15% oxygen by mass. The economic potential of the black powder recovered from degrading the tire is being explored based on its potential use as a sequestering agent and as a high energy, low ash, low polluting fuel. Both of these potential uses impact the economic model for the WOMBAT process (Figure 2). While the WOMBAT process has achieved its initial goal of degrading the tires into useful end products while generating no hazardous waste, the current reaction procedures have two drawbacks -- the process is quite slow, and the process requires too much reactor fluid (i.e., catalyzed nitric acid).

These limitations have been due, at least in part, to limitations in the design and the operation of our previous reactors. The WOMBAT IV reactor is now available and is being utilized in studies designed to minimize the process problems noted above. In addition, the WOMBAT IV reactor is a significant step forward in a concept of "complete" process

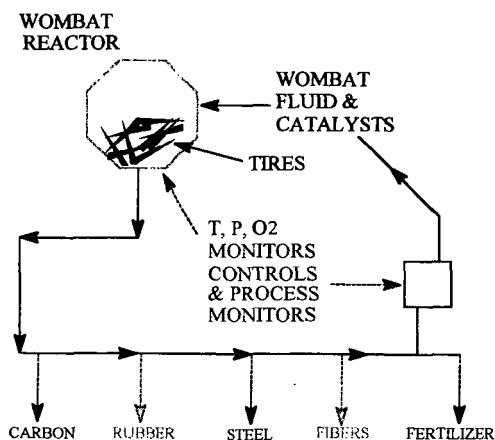
automation.

In an attempt to accelerate the reactor sequences and to improve the requisite fluid/tire materials ratio, several new reactor parameters have been introduced into our process procedures. To date, the effect(s) of controlling and increasing temperature, adding compressed air, and improving the fluid circulation within the reactor have all been studied using our new WOMBAT IV reactor (see Figure 3). In addition, the degradation of the reactor fluid is being studied in an attempt to develop a sensor which will allow for control of the entire process by microprocessor(s).

**CONCLUSION.** The rate(s) of at least some of the key reactions involved in the WOMBAT process have been accelerated by one order of magnitude.

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## SCHEMATIC OF THE WOMBAT PROCESS



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Figure 1

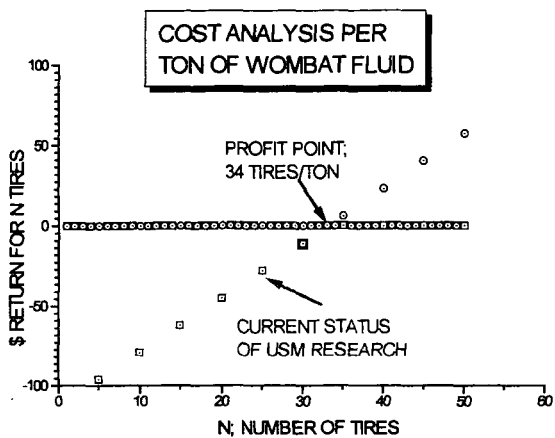
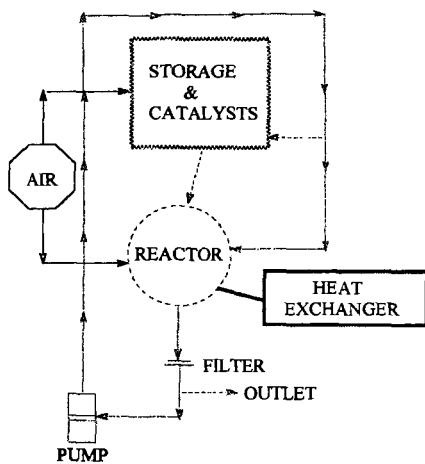


Figure 2

## SCHEMATIC OF WOMBAT REACTOR

FLOW OF WOMBAT FLUID



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Figure 3